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NOTES FOR THE APPLICATION OF THE MISSILE O&S COST MODEL.(U)
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NOTES FOR THE APPLICATION

OF THE

MISSILE O&S COST MODEL

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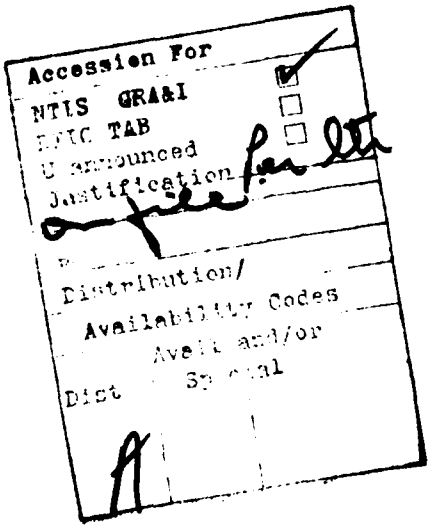
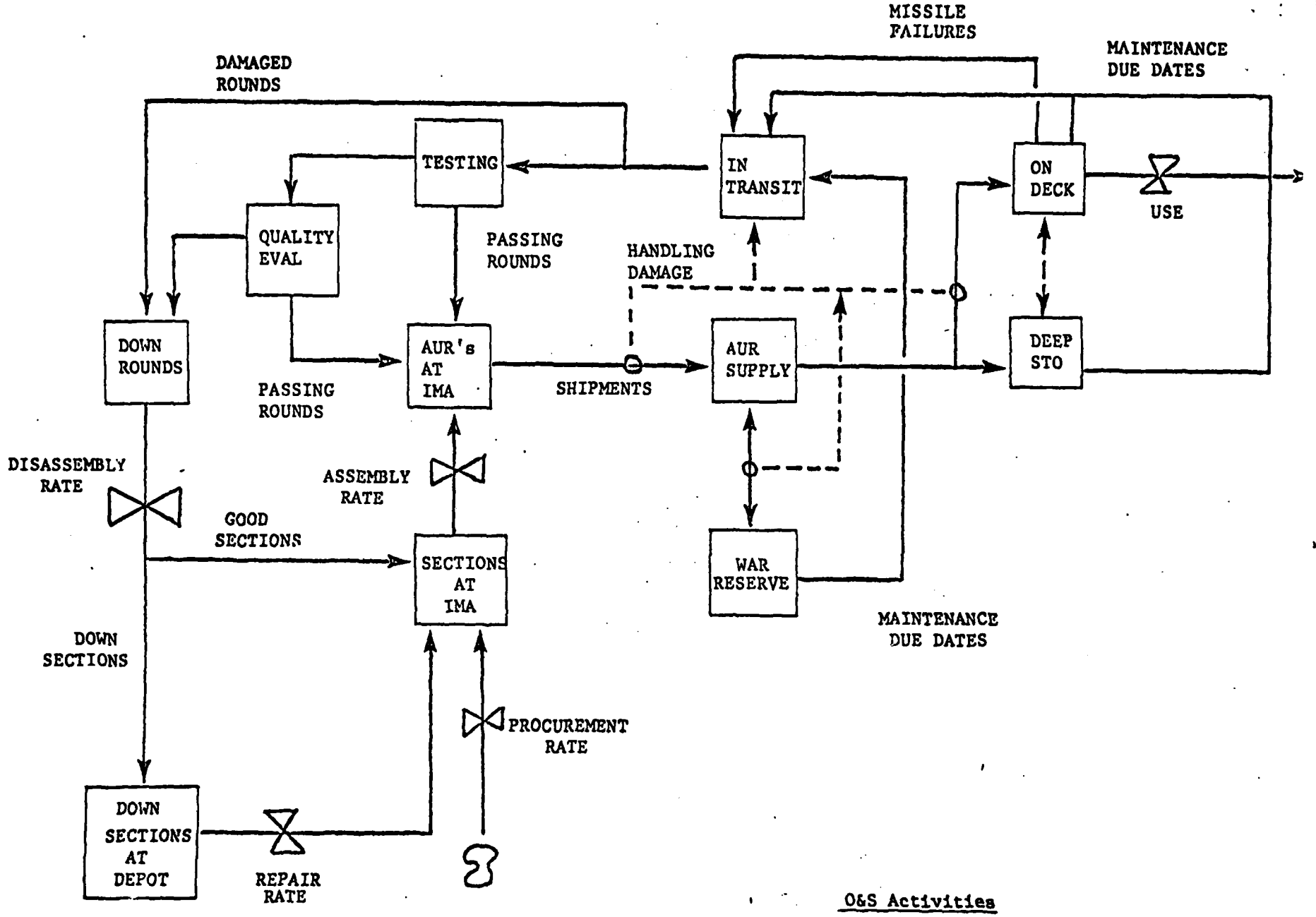


OVERVIEW OF O&S SYSTEM STRUCTURE

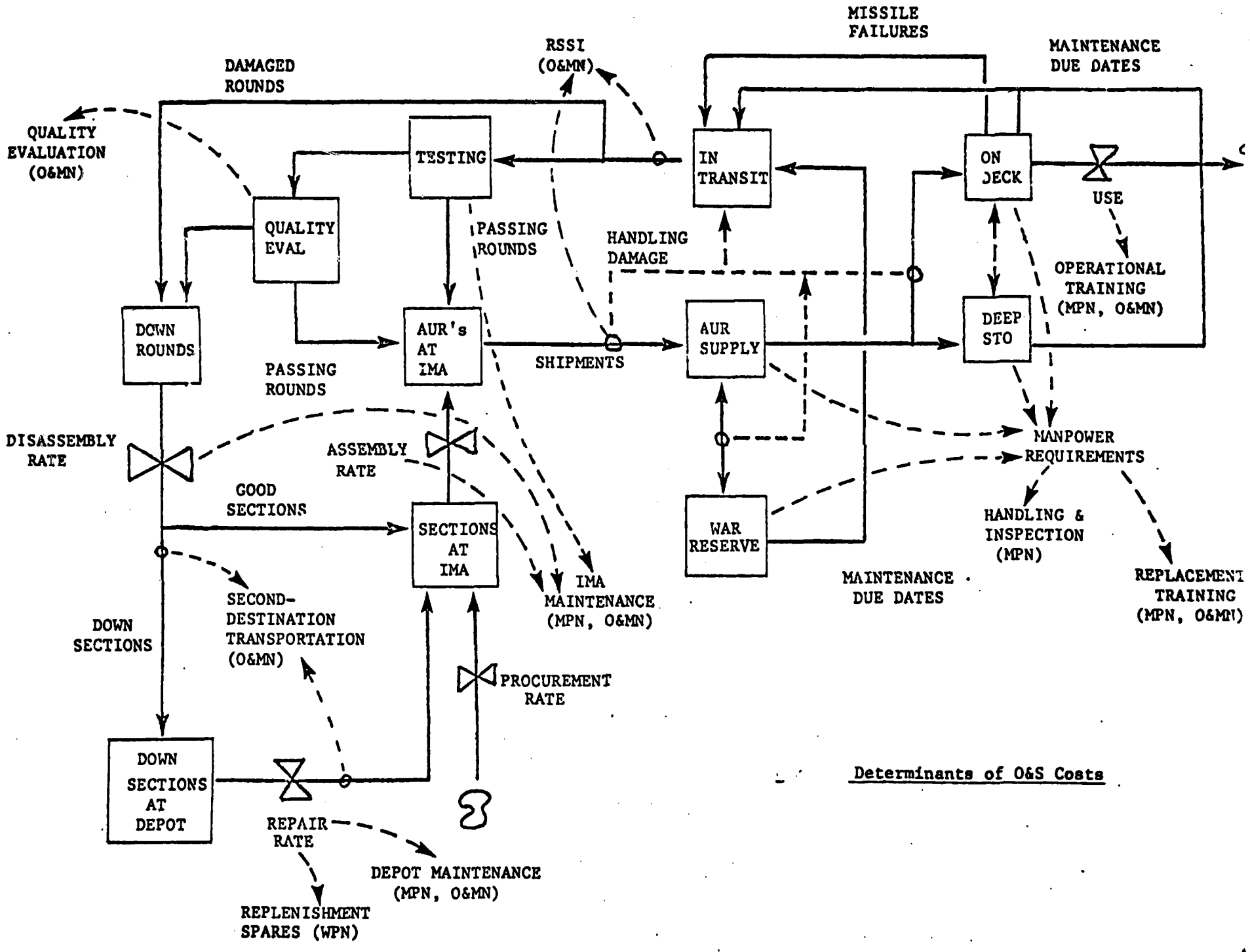
REPRESENTED BY THE MODEL



O&S Activities

OVERVIEW OF O&S COST CALCULATIONS

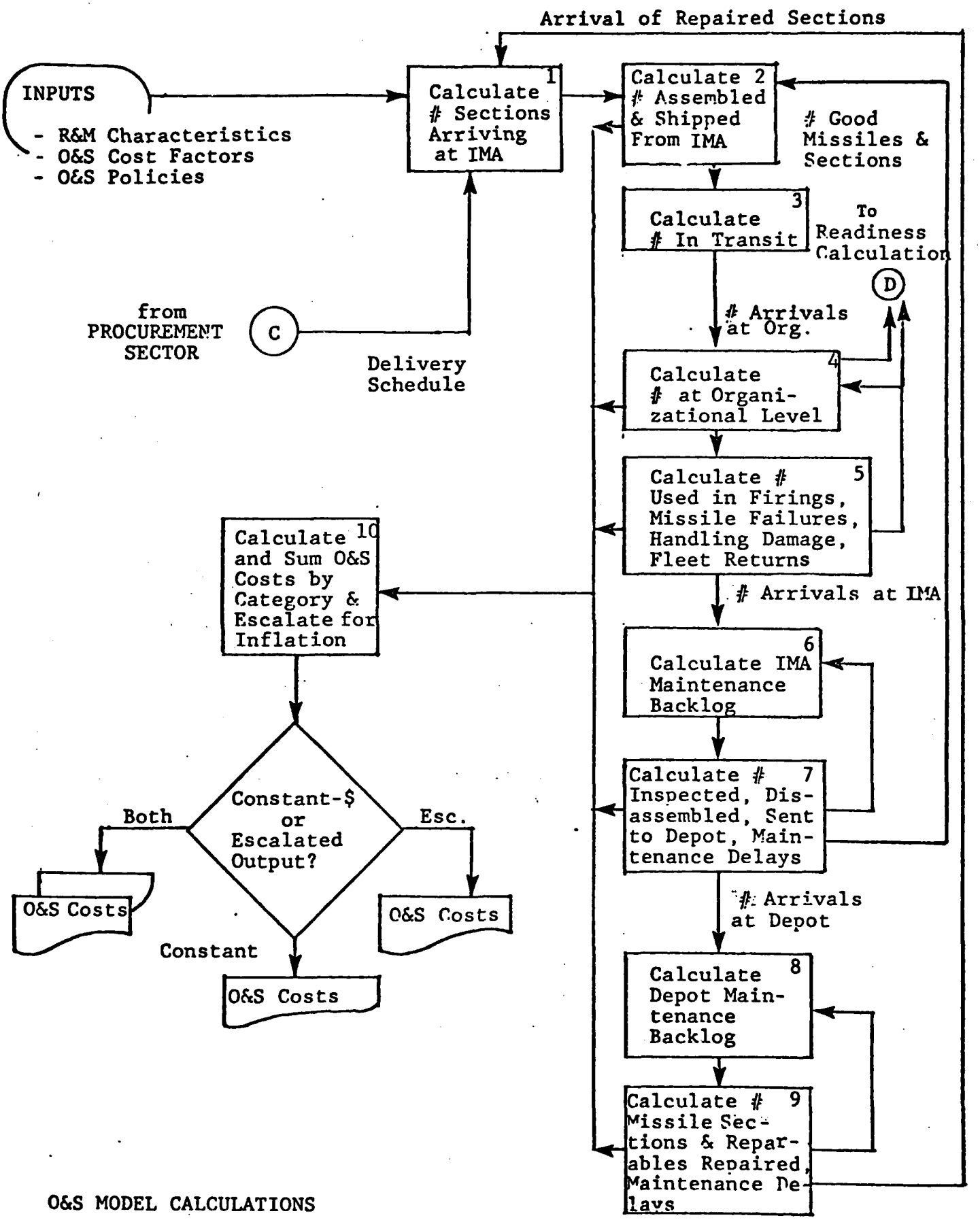
CONTAINED WITHIN THE MODEL



Determinants of O&S Costs

OVERVIEW OF

O&S MODEL CALCULATIONS



O&S MODEL CALCULATIONS

READINESS MEASURES GENERATED

BY THE MODEL

READINESS MEASURES

- NUMERICAL READINESS

  Number of all-up rounds (AUR's) available for operations, not undergoing maintenance or in transit to maintenance facilities

- PERCENTAGE READINESS

  $$= \frac{\text{"Ready" AUR's}}{\text{Rounds in System}}$$

  Rounds in system include the rounds and missile sections undergoing maintenance and in transit to maintenance facilities

- LIKELY READINESS

  = Numerical Readiness x Likelihood of Successful Checkout

  Likelihood of Successful Checkout = (1 - Handling Damage Rate) x (1 - Shelf Life Failure Rate) x (1 Aircraft Avionics/BIT "No-Go" Indication Rate)

- PERCENTATE LIKELY READINESS

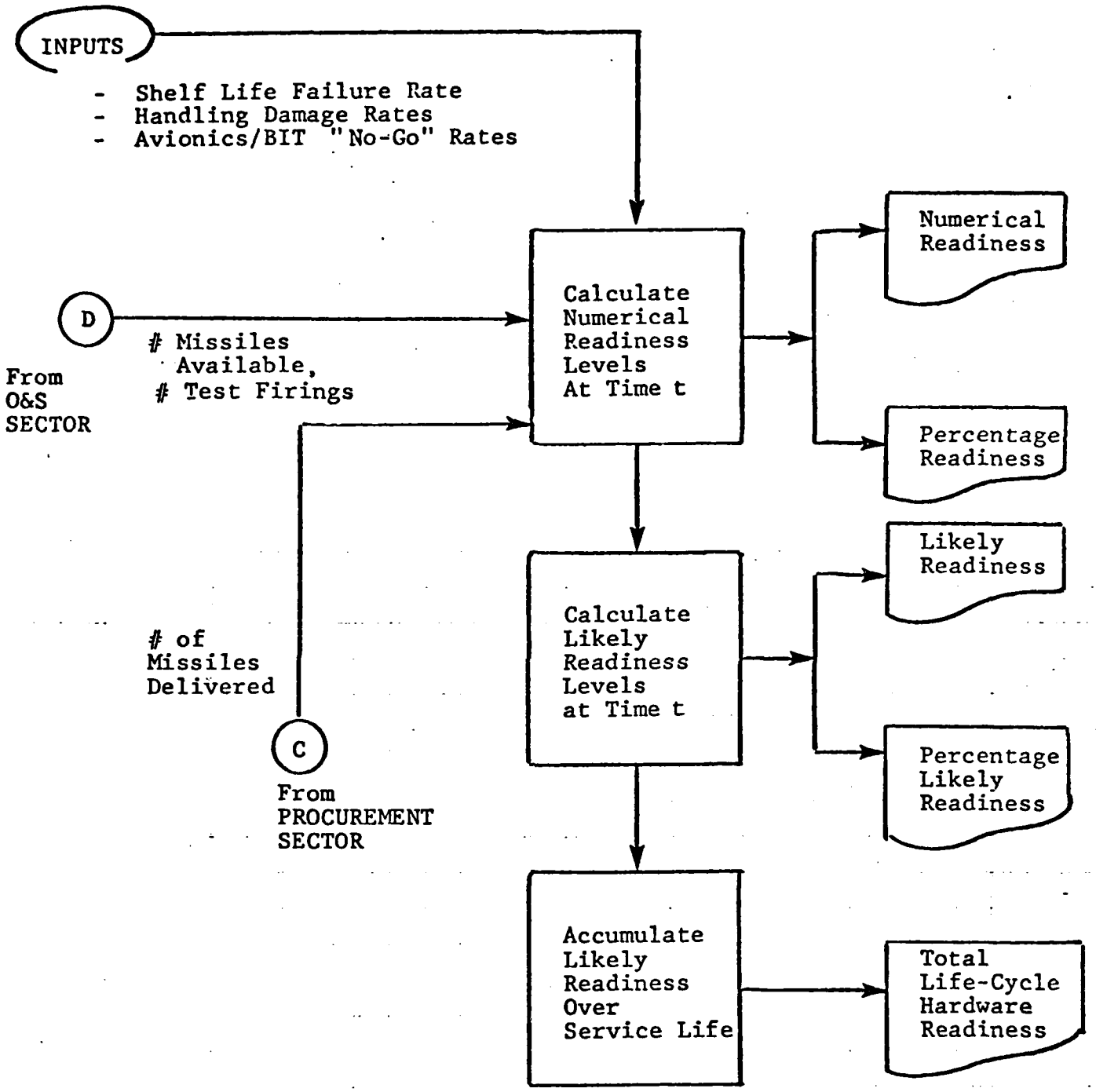
  $$= \frac{\text{"Likely Ready" AUR's}}{\text{Rounds in System}}$$

- TOTAL LIFE-CYCLE HARDWARE READINESS

  Cumulative number of AUR's "Likely to be Ready" over program life cycle

  Dimensions of "Ready Missile-Years"

  1 AUR x 1 Year = 1 Missile-Year



Readiness Calculation

O&S COST ELEMENTS GENERATED BY THE MODEL

O&S COST ELEMENTS

COST ELEMENT	BUDGET APPROPRIATION MPN	O&MN	WPN	VARIABLE NAME
HANDLING AND INSPECTION	X			C1
OPERATIONAL TRAINING	X	X		C2
INTERMEDIATE MAINTENANCE	X	X		C4
DEPOT MAINTENANCE	X	X		C6
SUPPLY SUPPORT		X		C7
QUALITY EVALUATION		X		C11
SECOND DESTINATION TRANSPORTATION		X		C14
RECEIPT, SEGREGATION, STORAGE, AND ISSUES (RSSI)		X		C15
REPLACEMENT TRAINING	X	X		C16
REPLENISHMENT SPARES			X	C17

O&S COST RELATIONSHIPS CONTAINED

WITHIN THE MODEL

O&S COST RELATIONSHIPS

COST ELEMENT	CALCULATION
Handling and Inspection	(Number of Men) x (Cost per Man per Year)
Operational Training	(Number of Training Firings) x (Cost per Firing)
IMA Maintenance:	
Maintenance Assembly Labor	(Number of Missiles Assembled) x (Manhours per Assembly) x (Cost per Manhour)
Missile Testing Labor	(Number of Missiles Tested) x (Manhours per Test) x (Cost per Manhour)
Missile Disassembly Labor	(Number of Missiles Disassembled) x (Manhours per Disassembly) x (Cost per Manhour)
Consumable Materials	(Assemblies) x (Consumables Usage) + (Tests) x (Consumables Usage) + (Disassemblies) x (Consumables Usage)
Overhead	(Total IMA Labor Costs) x (IMA Overhead Rate)
Depot Maintenance:	
Missile Section Repair Labor	(Number of Sections Repaired) x (Manhours per Repair) x (Cost per Manhour)
Reparables Repair	(Number of Reparables Repaired) x (Manhours per Repair) x (Cost per Manhour)
Consumable Materials	(Sections Repaired) x (Consumables Usage) + (Reparables Repaired x (Consumables Usage)
Overhead	(Total Depot Labor Costs) x (Depot Overhead Rate)

O&S COST RELATIONSHIPS

(continued)

COST ELEMENT	CALCULATIONS
Supply Support	(Total Consumables Used) x (% of Consumables Costs) + (Replenishment Spares Cost) x (% of Reparables Costs)
Quality Evaluation:	
Labor	(Number of Missiles Evaluated) x (Manhours per Evaluation) x (Cost per IMA Manhour)
Consumable Materials	(Number of Missiles Evaluated) x (Consumables Usage)
Overhead	(Quality Evaluation Labor Cost) x (IMA Overhead Rate)
Transportation	(Sections to and From Depot) x (Containerized Weight) x (Distance Shipped) x (Cost per Ton-Mile)
RSSI	(Rounds to and From IMA) x (Containerized Weight) x (Cost per Ton)
Replacement Training	(Manpower Level) x (Cost Per Man) ÷ (Average Turnover Time)
Replenishment Spares	(Number of Reparables Used) x (Average Cost per Reparables)

INPUTS TO

THE O&S COST MODEL

INPUTS TO THE O&S COST MODEL

DEFINITION OF VARIABLE	VARIABLE TYPE	VARIABLE NAME	ILLUSTRATIVE VALUE
Desired Number of AUR's "On Deck" from 1980 to 1986, 2-year intervals	T	TDODOT	0/80/140/200 per year
Desired Number of Training Firings from 1980 to 1986, 2-year intervals	T	DUROT	0/16/28/40 per year
Desired Firings per Organizational Unit	C	DUROR	2 per year
Switch, 1="Rotation" Policy 0=Fly Until Die	C	SWRO	0
Time "On Deck", when rotated	C	TODO	0.5 years
Tests per AUR "On Deck"	C	ATYO	2 per year
Normal Handling Damage Fraction	C	NHD	0.02 per move
Normal Indicated Missile Failure Rate	C	FRN	0.1 per BIT/ avionics test
Ratio of Indicated Missile Failures to Number of Actual Failures	C	MAFR	2
Shelf Life Failure Rate, "On Deck" and Deep Storage from 0 to 4 years, 0.5 year intervals	T T	ASL1OT ASL2OT	0/.012/.025/.038/.05/.068/ .074/.086/.098
Shelf Life Failure Rate, in Reserve from 0 to 10 years, 1-year intervals	T	FSLRT	0/.021/.041/.061/.081/.1/ .119/.137/.155/.173/.19
Maintenance Due Dates			
Organizational "On Deck"	C	MDODO	2 years
Organizational Deep Storage	C	MDDSO	2 years
Reserve Deep Storage	C	MDRES	5 years

INPUTS TO THE O&S COST MODEL
(continued)

DEFINITION OF VARIABLE	VARIABLE TYPE	VARIABLE NAME	ILLUSTRATIVE VALUE
Organizational Storage Capacity	C	CAPON	2000 missiles
Fraction Kept "On Deck"	C	ODOF	0.1
Shipment Capacity	C	CAPMN	1E6 missiles per year
Shipment Time, to Fleet	C	FWDTT	0.06 years
IMA Shipping & Handling Delay	C	IMAST	0.06 years
Inventory Coverage (Ratio of Stock to Use Rate), Missile Sections at IMA	C	AUSIT	0.06 years
Time to Test at IMA	C	IMATT	0.06 years
Time to Perform Quality Evaluation	C	IMAQT	0.06 years
Time to Disassemble at IMA	C	IMADT	0.06 years
Fraction of Missiles sent to IMA due to BIT/Avionics Indicators which Pass IMA Tests	C	TPFB	0.5
Fraction of Passing BIT/Avionics Missiles which are sent to Quality Evaluation	C	PBFQE	1.0
Ratio of Actual Missile Failures to Number of Indicated Failures among Fleet Returns	C	ATFR	0.5
Fraction of Passing Fleet Returns which are sent to Quality Evaluation	C	PSFQE	0.1
Labor Requirements per Missile At IMA			
Assembly	C	M1	16 manhours
Testing	C	M2	24 manhours
Quality Evaluation	C	MQ	24 manhours
Disassembly	C	M3	16 manhours

INPUTS TO THE O&S COST MODEL
(continued)

DEFINITION OF VARIABLE	VARIABLE TYPE	VARIABLE NAME	ILLUSTRATIVE VALUE
Average Available Consumables Delay, IMA & Depot	C C	AVDTI AVDTD	0.06 years 0.06 years
Fraction Consumables Available	C	CSAV	0.85
Unavailable Consumables Delay, IMA & Depot	C C	CXDTI CXDTD	0.25 years 0.25 years
Shipment Time, to Depot	C	REARTT	0.06 years
Section and Reparables Repair Times, at Depot	C C	SREPT PREPT	0.06 years 0.06 years
Inventory Coverage (Ratio of Stock to Use Rate), Reparables at Depot	C	PCOVT	0.06 years
Needed Reparables per Section	C	NPS	1
Fraction of Reparables Not Economically Repairable	C	FPX	0.2
Labor Requirements at Depot			
Section Repair	C	M4	40 manhours
Reparables Repair	C	M5	40 manhours
Available Reparables Delay	C	PACCT	0.06 years
Fraction Reparables Available	C	PSAV	0.85
Unavailable Reparables Delay	C	PXDTD	0.25 years
O&S COST FACTORS			
Cost per Enlisted Man	C	CPEM	10E3 $ per year
Cost Per Officer	C	CPOF	20E3 $ per year
Handling Manpower per Unit	C	HMMNO	2 men
Manpower Turnover Time	C	HMMTO	2.5 years
Cost per Training Firing	C	CURUO	5E3 $
Fraction of Firing Costs to O&MN	C	FC20	0.8

INPUTS TO THE O&S COST MODEL
(continued)

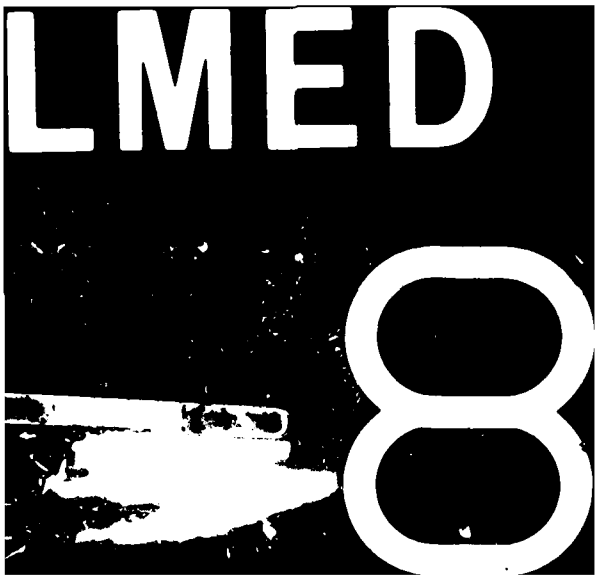
DEFINITION OF VARIABLE	VARIABLE TYPE	VARIABLE NAME	ILLUSTRATIVE VALUE
Fraction of Military Personnel	C	MPFI	0.2
At IMA & Depot	C	MPFD	0
Labor Cost at IMA	C	CPMH	12 $ per manhour
at Depot	C	CPSMH	16 $ per manhour
Overhead Rates at IMA	C	C4OR	1.25
& Depot	C	C6OR	1.5
Consumables Usage per Missile In:			
Assembly	C	CON1	50 $
Testing	C	CON2	50 $
Disassembly	C	CON3	50 $
Missile Section Repair	C	CON4	100 $
Reparables Repair	C	CON5	100 $
Fraction of Supply Support Costs on Value of Consumables &	C	C7CR	0.15
Reparables	C	C7PR	0.15
Containerized Missile Weight	C	AVMWT	0.4 tons
Containerized Section Weight	C	AVSWT	0.12 tons
Transportation Costs	C	CPMILE	0.10 $ per ton-mile
Distance Shipped	C	AVRD	3000 miles
RSSI Costs	C	CPRND	74 $ per ton
Time to Train EM's	C	TTEM	0.28 years
Cost to Train EM's, Other than Pay	C	C16EM	2000 $
Number of Major Reparables per Missile	C	NPAUR	20

INPUTS TO THE O&S COST MODEL

(continued)

PROCUREMENT/DELIVERY INPUTS

DEFINITION OF VARIABLE	VARIABLE TYPE*	VARIABLE NAME	ILLUSTRATIVE VALUE
Pilot Production Time Span	C	PIT	1 year
Number in Plot Lot	C	PIN	120 missiles
Number of Plot Models Used for T&E	C	RDPIN	40
Production Initiation Time	C	PRITN	1978
Full-Scale Production Time Span	C	PRTT	5 years
First-year (Pilot) Production Lot	C	NUM1T	120 missiles
Total Full-Scale Production Lot	C	NUMT	3000 missiles
Fraction of Full-Scale Lot In:			
Year 1	C	NUM1F	0
Year 2	C	NUM2F	0.12
Year 3	C	NUM3F	0.24
Year 4	C	NUM4F	0.26
Year 5	C	NUM5F	0.20
Year 6	C	NUM6F	0.18
Year 7	C	NUM7F	0
Fraction Cut Back in Stretch-Out	C	PRVDV	0
Date of Initial Cutback	C	PRVDTT	2000
Time Span of Cutback	C	PRDEL	0 years
Initial Delivery Delay	C	PROCD	1 year
Start of Simulation	C	TIMEN	1978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